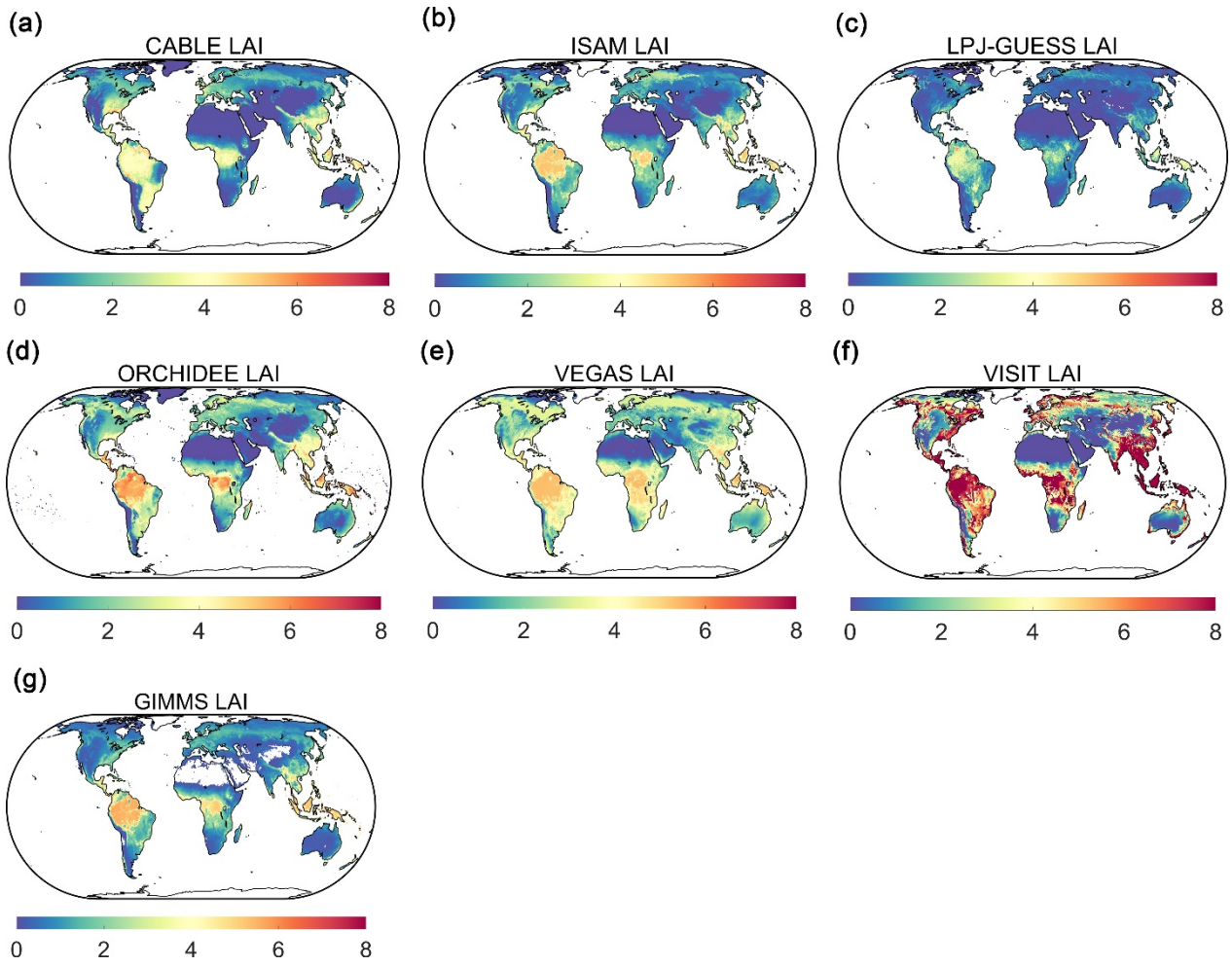

Figure S1. Spatial patterns of annually averaged GIMMS LAI and modeled LAI from 1982 to 2015.

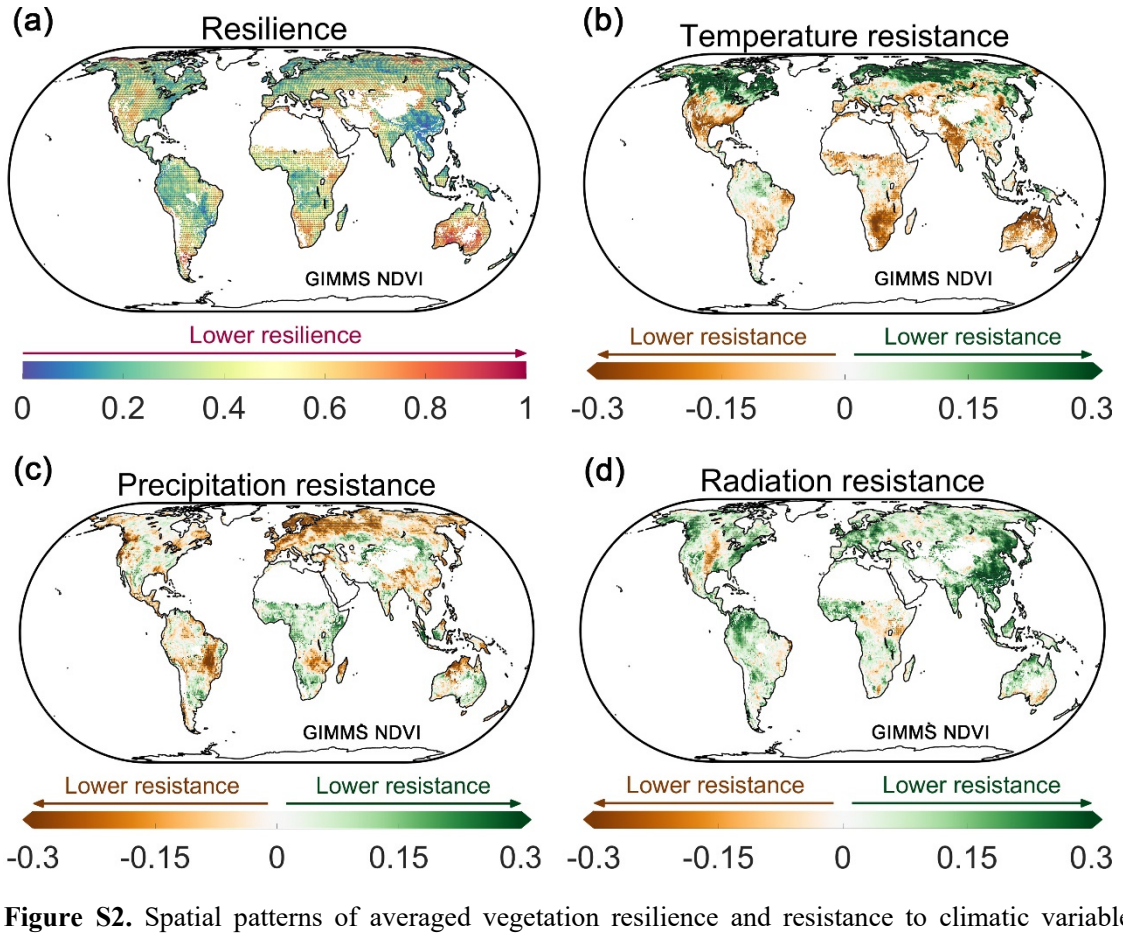

Figure S2. Spatial patterns of averaged vegetation resilience and resistance to climatic variables based on GIMMS NDVI. (a), vegetation resilience; (b), temperature resistance; (c), precipitation resistance; (d), radiation resistance. In each subfigure, stippling indicates that the vegetation resilience or climatic resistance is significant ($p < 0.05$) in the grid. Vegetation resilience is within the range of 0 and 1, and larger values suggest lower resilience. Climatic resistance is within the range of −1 and 1, and values with larger absolute magnitudes indicate lower climatic resistance.

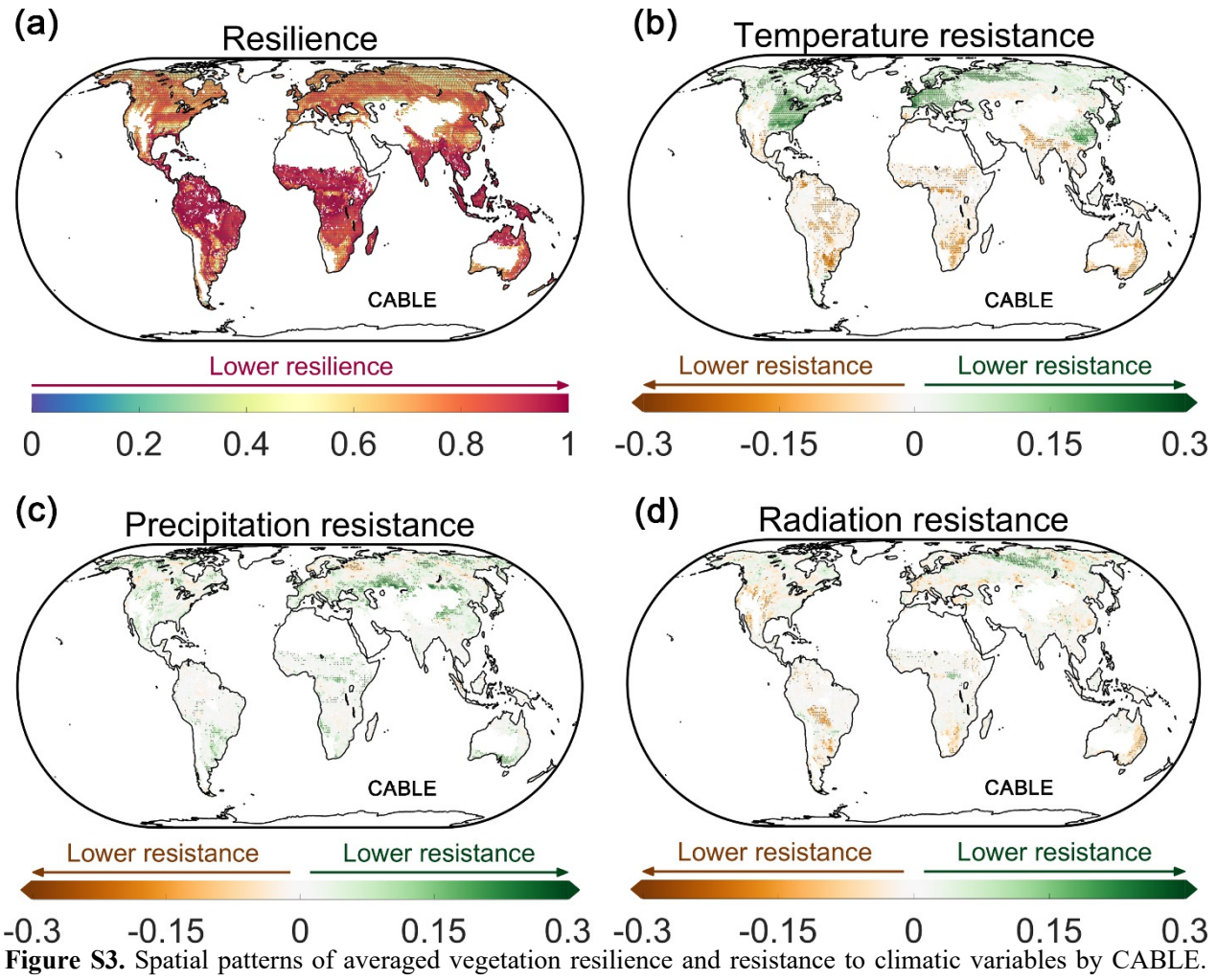

Figure S3. Spatial patterns of averaged vegetation resilience and resistance to climatic variables by CABLE. (a), vegetation resilience; (b), temperature resistance; (c), precipitation resistance; (d), radiation resistance. In each subfigure, stippling indicates that the vegetation resilience or climatic resistance is significant ($p < 0.05$) in the grid. Vegetation resilience is within the range of 0 and 1, and larger values suggest lower resilience. Climatic resistance is within the range of −1 and 1, and values with larger absolute magnitudes indicate lower climatic resistance.

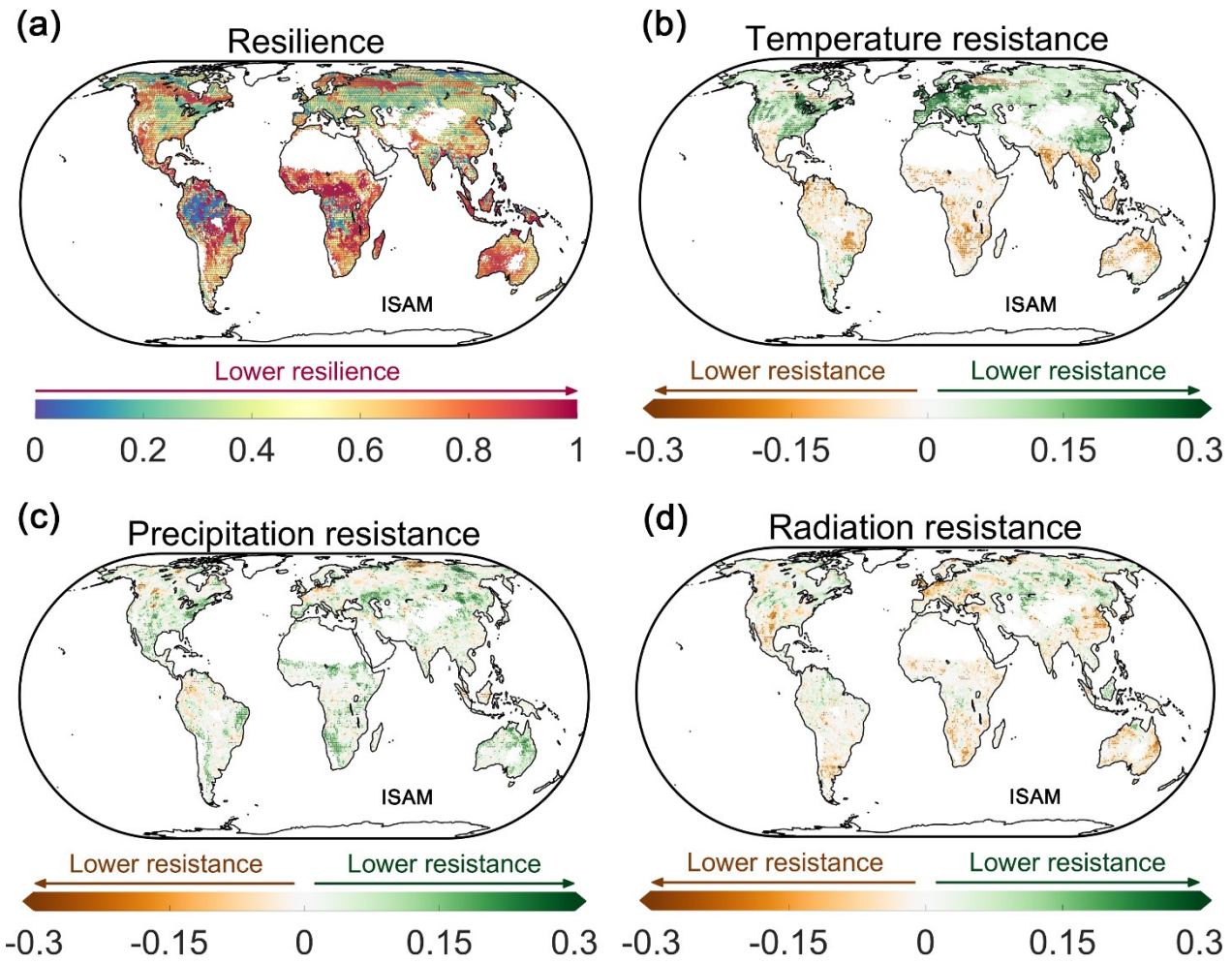

Figure S4. Spatial patterns of averaged vegetation resilience and resistance to climatic variables by ISAM. (a), vegetation resilience; (b), temperature resistance; (c), precipitation resistance; (d), radiation resistance. In each subfigure, stippling indicates that the vegetation resilience or climatic resistance is significant ($p < 0.05$) in the grid. Vegetation resilience is within the range of 0 and 1, and larger values suggest lower resilience. Climatic resistance is within the range of −1 and 1, and values with larger absolute magnitudes indicate lower climatic resistance.

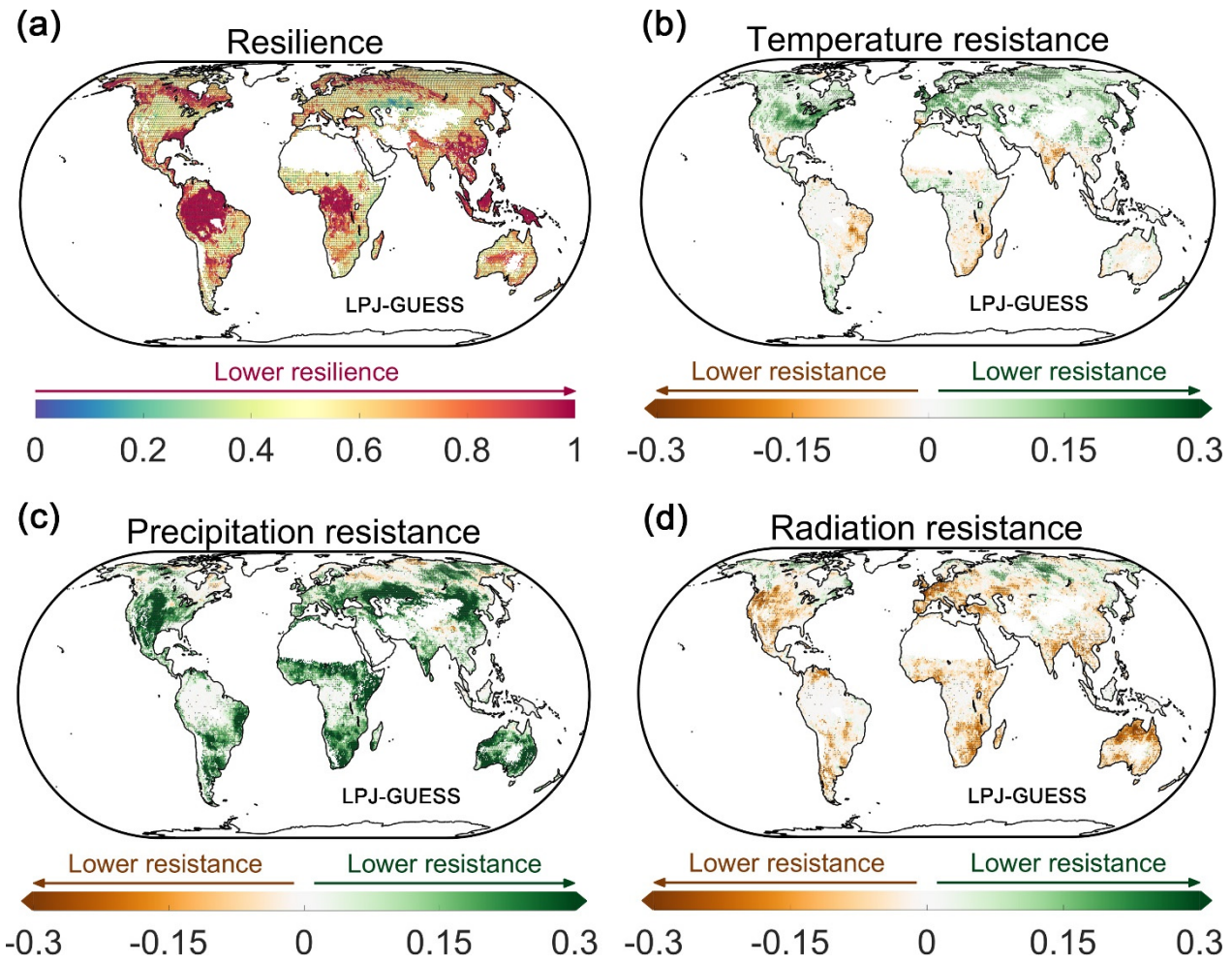

Figure S5. Spatial patterns of averaged vegetation resilience and resistance to climatic variables by LPJ-GUESS. (a), vegetation resilience; (b), temperature resistance; (c), precipitation resistance; (d), radiation resistance. In each subfigure, stippling indicates that the vegetation resilience or climatic resistance is significant ($p < 0.05$) in the grid. Vegetation resilience is within the range of 0 and 1, and larger values suggest lower resilience. Climatic resistance is within the range of −1 and 1, and values with larger absolute magnitudes indicate lower climatic resistance.

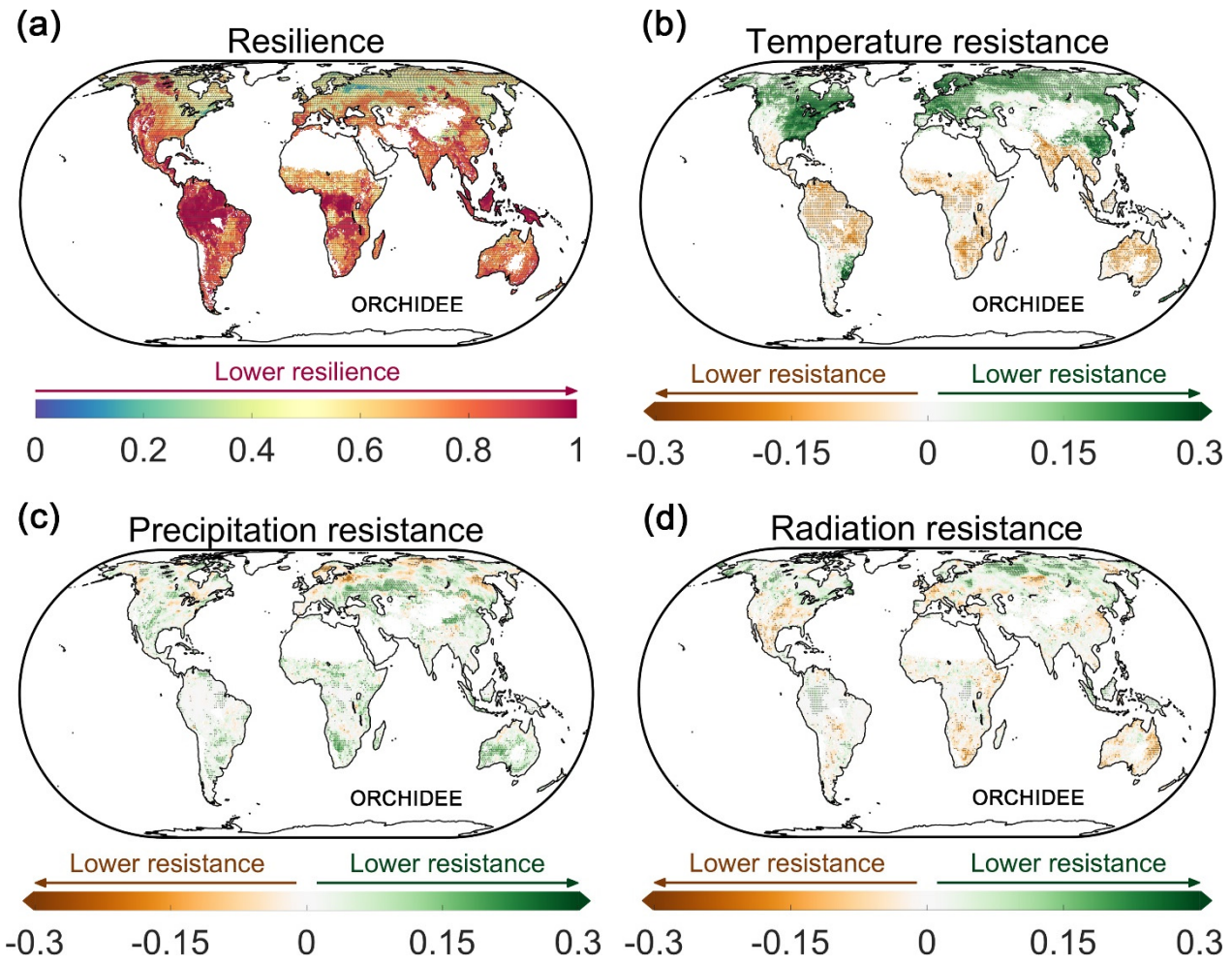

Figure S6. Spatial patterns of averaged vegetation resilience and resistance to climatic variables by ORCHIDEE. (a), vegetation resilience; (b), temperature resistance; (c), precipitation resistance; (d), radiation resistance. In each subfigure, stippling indicates that the vegetation resilience or climatic resistance is significant ($p < 0.05$) in the grid. Vegetation resilience is within the range of 0 and 1, and larger values suggest lower resilience. Climatic resistance is within the range of −1 and 1, and values with larger absolute magnitudes indicate lower climatic resistance.

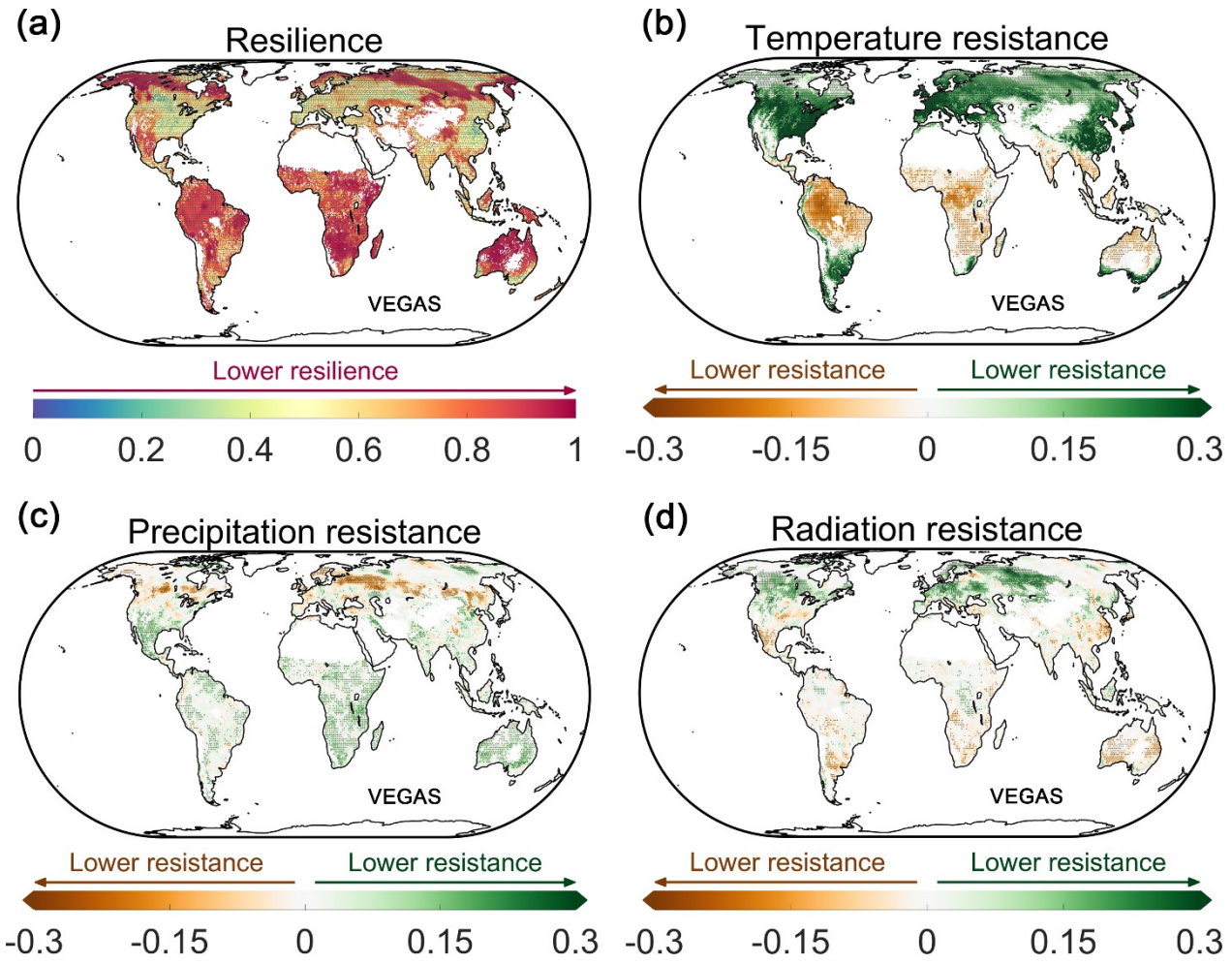

Figure S7. Spatial patterns of averaged vegetation resilience and resistance to climatic variables by VEGAS. (a), vegetation resilience; (b), temperature resistance; (c), precipitation resistance; (d), radiation resistance. In each subfigure, stippling indicates that the vegetation resilience or climatic resistance is significant ($p < 0.05$) in the grid. Vegetation resilience is within the range of 0 and 1, and larger values suggest lower resilience. Climatic resistance is within the range of −1 and 1, and values with larger absolute magnitudes indicate lower climatic resistance.

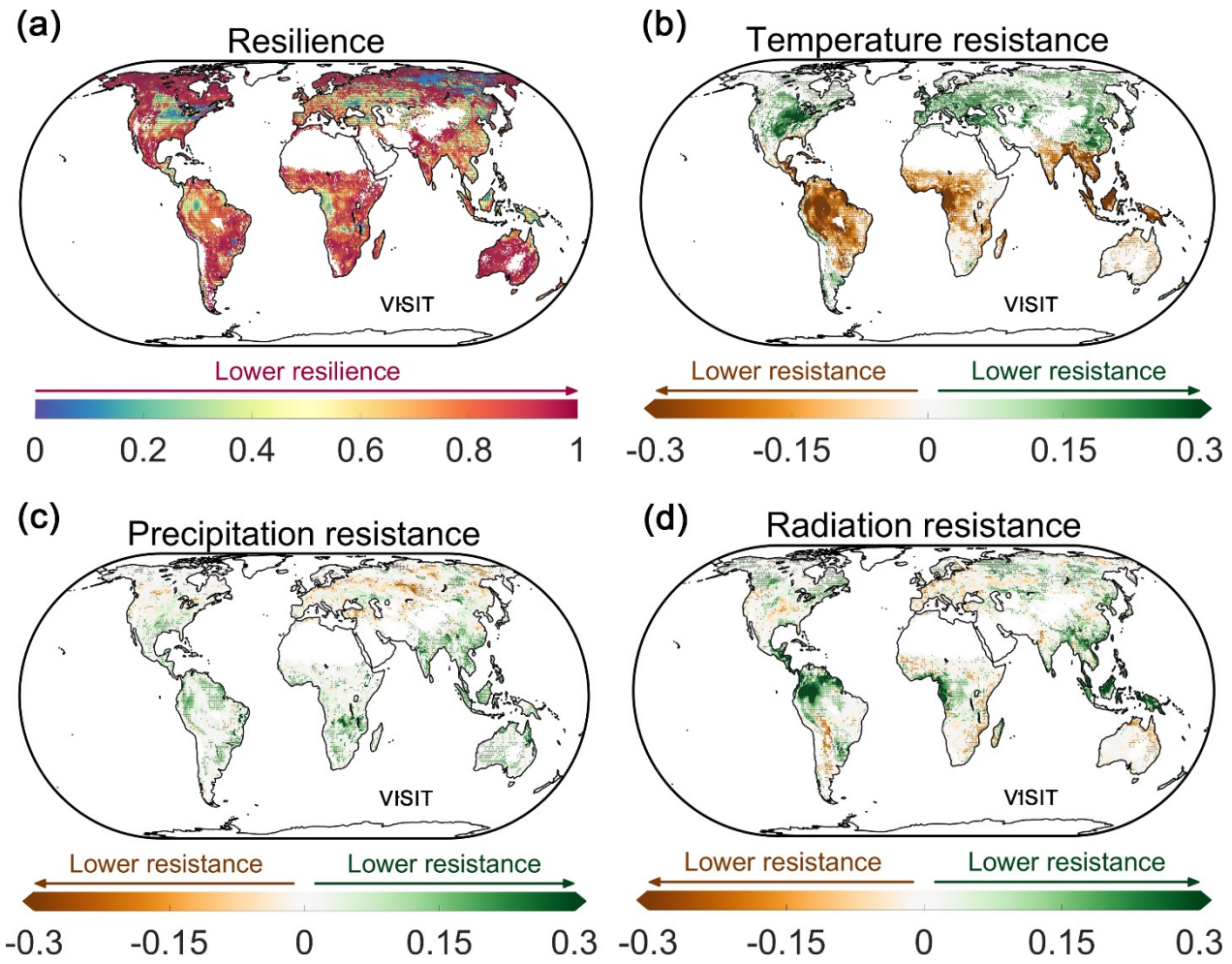

Figure S8. Spatial patterns of averaged vegetation resilience and resistance to climatic variables by VISIT. (a), vegetation resilience; (b), temperature resistance; (c), precipitation resistance; (d), radiation resistance. In each subfigure, stippling indicates that the vegetation resilience or climatic resistance is significant ($p < 0.05$) in the grid. Vegetation resilience is within the range of 0 and 1, and larger values suggest lower resilience. Climatic resistance is within the range of −1 and 1, and values with larger absolute magnitudes indicate lower climatic resistance.

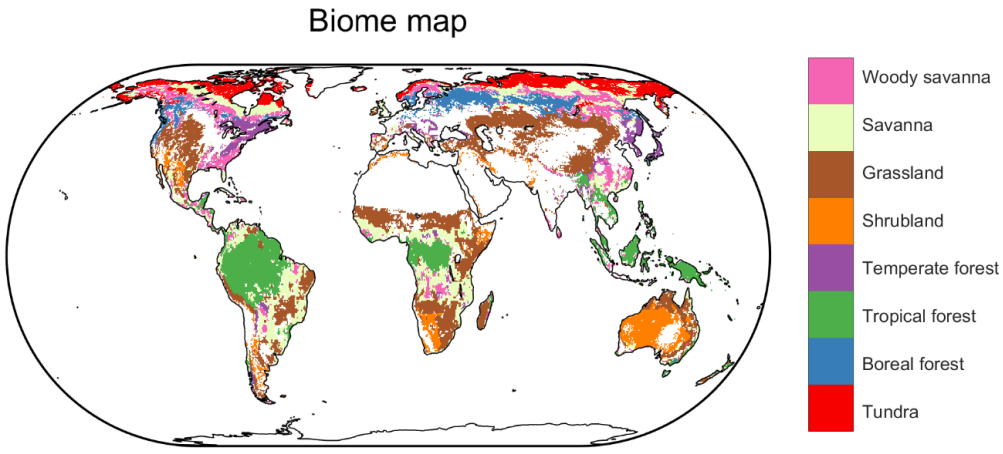

Figure S9. Biome map based on the MODIS IGBP system. The eight biomes include tundra, boreal forest, tropical forest, temperate forest, shrubland, grassland, savanna, and woody savanna.

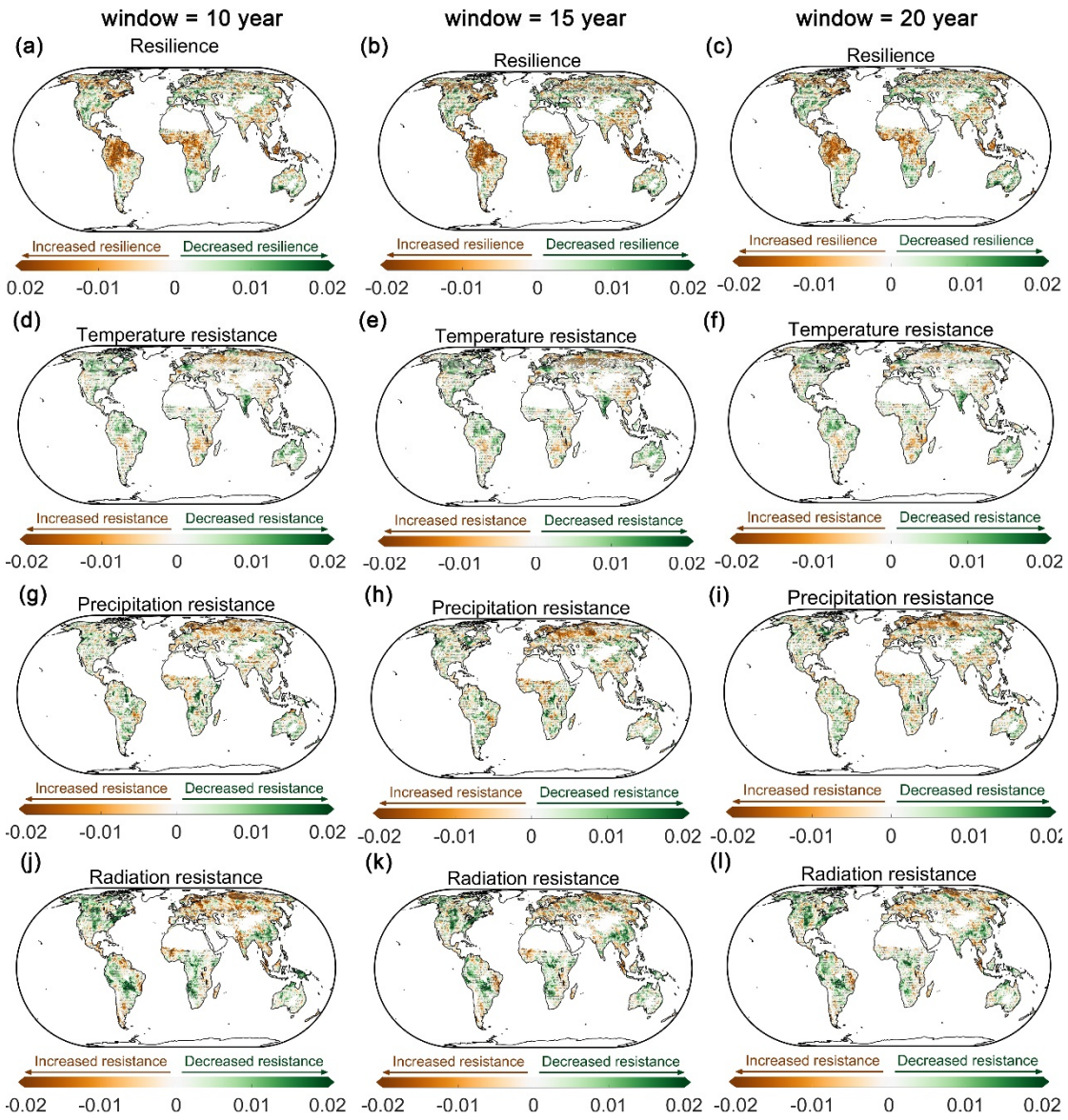

Figure S10. Spatial patterns of the changes in observation-based vegetation resilience and resistance with different window sizes of 10 years, 15 years, and 20 years. In each subfigure, stippling indicates that the change in observation-based vegetation resilience or climatic resistance is significant ($p < 0.05$) in the grid. A positive value of the linear trend represents decreased resilience and resistance, and a negative value of the linear trend represents increased resilience and resistance.

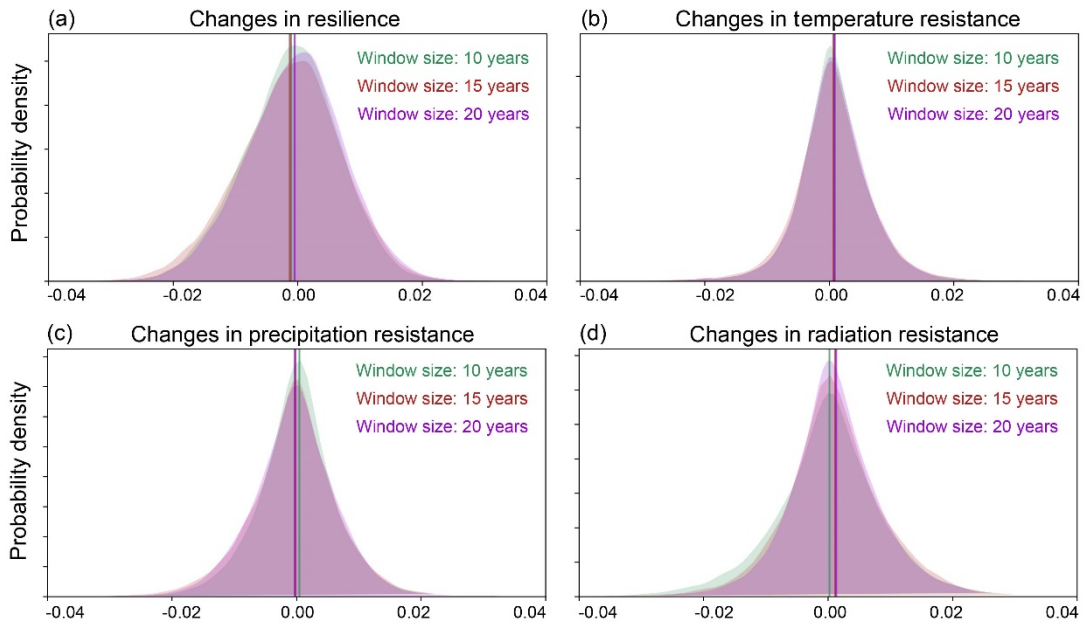

Figure S11. Probability distributions of the changes in observation-based vegetation resilience and resistance with different window sizes of 10 years, 15 years, and 20 years. The distribution curves are fitted with kernel smoothing function estimates for the changes in observation-based vegetation resilience and resistance. Vertical lines represent the mean values of the changes in observation-based vegetation resilience and resistance with different window sizes.

Table S1. Median values of observation and model mean vegetation resilience and resistance in eight natural biomes.

	Resilience		Temperature resistance		Precipitation resistance		Radiation resistance	
	Observation	Model	Observation	Model	Observation	Model	Observation	Model
Tundra	0.2407	0.6370	0.1484	0.0577	−0.0676	0.0125	0.0902	0.0240
Boreal forest	0.2476	0.6760	0.1087	0.0851	−0.1687	−0.0024	0.1838	0.0345
Tropical forest	0.2441	0.7984	0.0217	−0.0731	−0.0186	0.0188	0.0739	0.0256
Temperate forest	0.2430	0.5945	0.1077	0.1323	−0.0697	0.0266	0.2002	0.0197
Shrubland	0.5053	0.7887	−0.1574	−0.0229	0.0303	0.0957	0.0408	−0.0332
Grassland	0.4662	0.6917	−0.0068	0.0481	0.0493	0.0744	0.0226	−0.0090
Savanna	0.3054	0.7447	0.0406	0.0463	−0.0451	0.0344	0.0869	0.0044
Woody savanna	0.2616	0.7291	0.0886	0.0764	−0.0709	0.0233	0.1578	0.0183
All biomes	0.3115	0.7001	0.0395	0.0407	−0.0483	0.0359	0.1120	0.0110

Table S2. Mean K values of vegetation resilience and resistance changes in eight natural biomes derived from observation and models.

		Tundra	Boreal forest	Tropical forest	Temperate forest	Shrubland	Grassland	Savanna	Woody Savanna
Resilience (10^{-3} yr^{-1})	GIMMS LAI	−1.62	−2.66	−9.94	−2.91	4.16	1.11	−2.63	−1.00
	CABLE	0.75	−0.20	−0.07	−0.82	−0.99	−0.79	−0.00	−0.24
	ISAM	−5.24	−0.16	0.25	0.32	−1.66	0.01	−0.87	−0.17
	LPJ-GUESS	0.91	0.83	0.33	−0.38	−0.34	−1.40	0.61	0.81
	ORCHIDEE	−0.43	−2.73	−0.18	0.29	−1.29	−0.30	−1.31	−1.82
	VEGAS	1.96	1.38	−0.31	−1.03	−0.02	−0.02	−0.53	−1.97
	VISIT	0.62	−0.37	−2.53	0.26	−0.23	0.80	0.01	−0.54
	Model mean	−0.23	−0.21	−0.42	−0.23	−0.75	−0.29	−0.35	−0.66
Temperature resistance (10^{-3} yr^{-1})	GIMMS LAI	−1.93	−0.80	2.29	2.20	2.29	1.30	−0.22	0.31
	CABLE	−0.47	−0.53	−0.26	−0.01	1.02	0.33	0.10	0.36
	ISAM	−0.50	1.27	−0.14	1.64	−0.48	−0.26	0.18	0.41
	LPJ-GUESS	−0.21	−0.28	0.05	−0.16	0.26	−0.00	−0.09	−0.09
	ORCHIDEE	−1.10	−2.89	−0.69	0.56	−0.34	−0.27	−0.76	−1.11
	VEGAS	0.23	−1.04	0.70	0.11	−0.46	−0.36	0.36	0.15
	VISIT	−0.46	−0.51	1.81	0.23	0.39	−0.03	0.07	0.31
	Model mean	−0.42	−0.66	0.24	0.40	0.07	−0.10	−0.03	0.05
Precipitation resistance (10^{-3} yr^{-1})	GIMMS LAI	−1.78	−5.40	2.27	2.51	1.17	0.64	−0.26	−1.65
	CABLE	0.57	0.63	0.55	0.16	1.36	0.50	0.57	0.85
	ISAM	−0.99	0.60	1.59	−0.29	0.19	0.11	0.59	0.95
	LPJ-GUESS	1.03	−0.13	−0.08	−0.11	2.11	1.71	0.08	0.19
	ORCHIDEE	−0.46	0.21	0.14	0.06	1.05	0.27	0.38	0.15
	VEGAS	−0.06	−2.48	1.08	0.30	0.41	0.24	0.46	0.42
	VISIT	0.19	−0.16	0.82	0.23	0.01	0.10	0.25	0.19
	Model mean	0.05	−0.22	0.69	0.06	0.86	0.49	0.36	0.46
Radiation resistance (10^{-3} yr^{-1})	GIMMS LAI	−1.41	1.57	3.89	1.84	3.43	1.24	0.81	1.82
	CABLE	−1.42	−1.13	0.85	0.28	0.84	0.22	−0.32	−0.273
	ISAM	−2.06	−2.13	0.87	−0.06	−0.68	−0.33	−0.35	−0.46
	LPJ-GUESS	0.30	−1.53	0.45	1.01	3.78	1.15	−0.80	−1.01
	ORCHIDEE	−1.47	−1.09	0.75	0.23	−0.32	−0.13	−0.29	−0.41
	VEGAS	−0.24	0.38	0.51	0.84	−0.73	−0.23	−0.18	0.72
	VISIT	−1.02	−1.30	1.67	1.05	0.69	0.05	−0.11	−0.16
	Model mean	−0.99	−1.13	0.85	0.56	0.60	0.12	−0.34	−0.26